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EFFECT OF CROSSING ON THE PRODUCTIVITY OF DUCKS

I.—Growth

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This work was carried out on two pure bred groups of ducks, Pekin and Khaki-Campbell, and their reciprocal crosses.

The main results arrived at, were as follows :

1. The body weights at hatching of P. & KP., were heavier than K. and PK. At all the subsequent ages P was the heaviest and K was the lightest. KP were heavir in body weight than PK through the period of study, but the differences were negligible at 12 weeks of age and thereafter.

2. The absolute gain in body weight for pure breds and cross breds reached its maximum during the period from 4 to 8 weeks of age.

3. The highest amount of feed consumed during the period from hatching till 12 weeks of age occurred during the period from 4 to 8 weeks of age. The total amount of feed consumed per bird till 12 weeks of age was 7.356, 7.418, 7.153 and 4.760 kg. for P, KP, PK and K respectively. The accumulative efficiency of feed utilization till the 12th weeks of age was 3.36, 4.03, 3.55 and 2.86 pound of feed per pound gain in weight for P, KP, PK and K respectively.

Crossing was generally practiced to increase growth rate in chicken. In ducks, Horn *et al.* (1952), working on crosses between Muscovy drakes and indigenous Hungarian white females, and Sennikov and Markova (1965), working in crosses between Russian Pekin drakes and German Pekin ducks, showed that crosses had higher growth rate tan the two parental breeds. However, Stohle and Gerencsoe (1961), found that the crossbreds between Muscovy and Pekin had intermediate body weight between the two parental breeds. Meanwhile, Mauch and Boian (1958), found that the rate of growth of the crosses between Pekin males and Muscovy females was slower than that of Pekin. Pop and Georgescu (1964), found also that crosses between Pekin and Khaki-Campbell breeds had intermediate average body weight compared with the two parental breeds at 3 months of age. Wessels and Wilbraham (1962), found that the Campbell ducklings were considerably and significantly smaller than the Pekin and their crossbreds at 8 to 12 weeks of age. Pekin exceeded slightly the crossbreds at 8 weeks of age. At the subsequent ages (10 and 12 weeks), the Pekin was greatly heavier than the crossbreds.

With respect to the efficiency of feed utilization, Siviki (1956), Dahnovskii (1961), Dakhnovsky (1962) and Sennikov and Markova (1965) showed that the crossbred ducks were more efficient than the parental breeds. However, Stasko and Mardiak (1963), Pop and Georgescu (1964), showed that the crosses between Pekin and Campbell were less efficient than the Pekin, but more efficient than the Campbell. When Muscovy drakes were mated with Hungarian ducks the crosses showed no appreciable differences in feed utilization as compared to the two parental breeds (Horn *et al.* 1952).

Materials and Methods

On December 1965 the following four matings were done using 15 drakes and 50 ducks in each: Pure Pekin (P), pure Khaki-Campbell (K), P males × K females (PK), and K males × P females, (KP).

The temperature of the floor brooders used for ducklings ranged between 95°F (at the first week), and 75°F (at the fifth week). After the 5th week of age, the ducklings were transferred to shallow pooles during the day time, and were shifted to the brooders during the night. This procedure was used until 12 weeks of age when the birds were transferred to the houses of adult ducks.

The ration of the ducklings consisted of 25% corn, 25% rice bran, 10% wheat broad beans, 25% wheat bran, 5% cotton seed meal. The ration was also supplemented with 1.5% lime stone, 1% sodium cloride, 0.1% Terramycin, 0.2% vitamin A + D_3 and 3% skim milk or fish meal. The mash was mixed with skim milk when offered to the ducklings at the brooding stage. Green fodder was supplied as Egyptian clover in witner, and green corn leaves in summer.

Weights were recorded every two weeks till 24 weeks of age. Relative growth rate was computed according to the formula R.G.R. $= \frac{W_2 - W_1}{\frac{1}{2}(W_2 + W_1)} \times 100$

The number of ducklings used for studying feed efficiency from hatch until 12 weeks of age were 45 P, 48 K, 44 K and 45 KP. No green fodder was offered to the birds used in this study.

Results and Discussion

Body weight.

Comparing body weight of the four groups it is clear that Pekin ducklings have the highest body weight all over the period of study (Table 1). The crosses were of intermediate body weight between the two parental breeds, while the Khaki Campbell had the lowest body weight. Pop and Georgescu (1964) working on the crosses of Pekin and Khaki-Cambpell, found similar results.

The Pekin ducklings at hatch were heavier than those of the Campbell, showing a clear breed difference. The differences in egg size of the two different breeds may account for this. Similar differences in hatching weights were also observed in chiken by Godfrey *et al.* (1953), Pop and Schaible (1957), Kamar and Mostageer (1963), Doncev and Cvetanov (1964) and Gibes and Czehowics (1965).

TABLE 1.—AVERAGE ABSOLUTE BODY WEIGHT (IN GRAMS)

Age in weeks	Breeds and Crosses							
	P	No*	KP	No*	PK	No*	K	No*
0	45.8	208	45.4	283	37.5	196	35.8	164
2	148.2	204	140.1	236	112.4	140	98.8	146
4	462.3	201	425.7	238	326.4	138	266.5	139
6	866.5	186	818.8	234	736.0	131	590.7	136
8	1288.1	177	1209.0	212	1178.4	114	879.0	119
10	1673.3	167	1573.7	208	1494.3	113	1144.2	117
12	1934.5	164	1970.6	197	1770.8	111	1366.2	109
14	2046.2	158	1870.6	185	1842.2	109	1458.6	102
16	2102.7	157	1961.3	189	1920.4	103	1533.5	93
20	2178.1	142	2007.0	187	1908.4	99	1571.5	89
24	2204.9	126	1953.9	150	1855.0	92	1590.6	80

* No = The number of individuals used.

The Crossbred weights at hatch were almost similar to those of their maternal breeds, indicating the presence of maternal effect. In chickens such maternal effects were also detected by Smith and Jaap (1957). The analysis of variance of the effect of breed on body weight at hatch confirms the foregoing statements (Table 3).

The ducklings which hatched in March and April had heavier weights than those hatched in February and May, (Table 2) . However, the hatch effect proved to be of no statistical significance at this age. Peljtcer (1963), noticed that body weight at hatch differs according to season.

TABLE 2.—THE AVERAGE BODY WEIGHT OF DUCKS HATCHED AT DIFFERENT MONTHS (IN GRAMS)

Age in Weeks	(P)				(KP)				(PK)				(K)			
	Feb.	March	April	May	Feb.	March	April	May	Feb.	March	April	May	Feb.	March	April	May
At hatch . . .	45.1	45.6	44.3	48.9	47.5	44.8	43.4	47.1	39.0	27.5	38.2	35.1	38.5	37.5	35.4	33.6
2	94.0	153.1	176.1	169.0	197.0	152.0	156.3	146.6	81.5	121.2	131.6	105.0	66.6	100.5	92.8	138.1
4	233.1	481.2	555.6	532.6	291.6	493.2	467.5	429.5	259.0	271.0	409.1	327.4	40.71	286.2	31.7	239.9
6	609.3	985.0	989.5	920.6	733.7	924.0	903.0	672.3	683.6	710.2	805.3	710.1	523.1	534.7	640.0	640.4
8	1017.0	1359.0	1468.7	1217.3	1167.9	1224.2	1321.7	1065.8	1041.1	1377.5	1193.8	1096.0	765.0	828.5	951.5	934.9
10	1339.6	1740.5	1829.5	1705.4	1494.1	1630.8	1635.1	1504.1	1362.4	1446.3	1592.4	1527.0	1052.8	1115.9	1209.4	1165.9
12	1758.7	1932.9	2033.3	1763.9	1720.5	1837.9	1817.9	1773.1	1623.9	1687.5	1959.5	1718.1	1288.4	1314.1	1449.8	1370.5
14	1918.8	2094.8	2121.7	2036.0	1814.1	1704.6	1934.5	1814.0	1703.1	1751.2	1904.3	1933.8	1400.7	1333.1	1508.8	1504.0
16	1961.6	2276.7	2094.5	2169.0	1898.4	2083.3	1963.1	1960.6	1838.8	1933.3	1958.7	1939.0	1520.0	1440.0	1548.5	1546.4
20	2107.2	2261.7	2130.0	2329.3	2028.5	2034.8	1915.2	1109.4	1771.3	1904.0	1955.5	1978.8	1575.0	1419.2	1573.6	1636.0
24	2077.0	2286.5	2182.3	2325.8	1869.3	2040.0	1952.4	1995.8	1914.6	1977.0	1936.4	1648.4	1616.3	1616.3	1573.2	1523.5

TABLE 3.—F. VALUES FOR BODY WEIGHT FROM HATCH TILL 24 WEEKS OF AGE.

Source of variance	at hatch	at 4 weeks	at 8 weeks	at 12 weeks	at 16 weeks	at 20 weeks	at 24 weeks
Between hatches	0.21 NS	3.92 NS	0.54 NS	0.3 NS	0.3 NS	0.11 NS	0.12 NS
Within hatches							
(*a*) Between P & K mothers. . .	8.04**	18.26**	6.26**	2.94 NS	2.89 NS	2.26 NS	2.54 NS
Between P & KP	0.08 NS	0.07 NS	0.42 NS	0.81 NS	0.46 NS	0.71 NS	1.06 NS
Between K & PK	0.23 NS	1.72 NS	1.75**	2.06 NS	1.90 NS	1.50 NS	0.98 NS
(*b*) Between purebreds and crossbreds	0.16 NS	0.62 NS	0.17 NS	0.09 NS	0.12 NS	0.01 NS	0.6 NS
Between purebreds	4.95**	14.54**	7.75	6.34**	6.41**	4.40*	4.37*
Between crossbreds	3.16 NS	4.90*	0.61 NS	0.001 NS	0.05 NS	0.01 NS	1.00 NS

Degree of fredem for body weight at hatch 4, 8, 12, 16, 20 and 24 weeks of age were 817, 704, 615, 569, 531, 504 and 435 respectively.

Degrees of fredem within hatches = 3

* Significant (at 5% level)

** Highly significant (at 1% level)

NS not significant,

With regards to the body weight at 4 weeks of age it is obvious that the same picture of the weight at hatch still holds, as shown also by the analysis of variance (Table 3). However, the sum of squares within hatches was divided in a different manner to study the significance of the difference between the crossbreds. This analysis shows that there exists a significant difference between the two reciprocal crosses.

At eight weeks of age, the picture changed. The statistical analysis (Table 3) indicated no hatch effect at this age, and this persisted also during all the subsequent ages. However, the difference between the two reciprocal crosses was of no statistical significance indicating the absence of maternal effect. Smith and Jaap in chicken (1957) observed also that maternal effect was not clear after 8 weeks of age. However, Godfrey *et al*, (1953) in chicken also, observed no maternal effect after 4 weeks of age.

At this age, however, there was still a significant difference between the two purbereds, which persisted during all the ages studied. A sgnificant difference can also be observed between the weights of the progeny of P and K mothers.

At twelve weeks of age, the only significant difference was that between the two purebred groups. The two purebred groups however, are expected to be widely different in body weight, since P is a meat producing breed and K is an egg producing one. No maternal effects between reciprocal crosses were observed. Also no significant differences were noticed between progenies of K and P mothers. The increase in weight after the twelfth week of age became small as shown im Table (1).

Table (2), shows the average gain every two weeks from hatch till 24 weeks of age. It can be seen that the most rapid increase occurred during the period from 4 - 12 weeks ; the maximum gain was that of the period from 6-8 weeks in all the breeds and crosses studied except K,in which the peak occurred during the period of 4 to 6 weeks.

Relative Growth Rate:

Table (4), shows that the highest relative growth rate occurs during the first12 weeks of age in all the 4 groups of ducklings studied,after which period it became very low. The picture of relative growth rate for the P and KP was almost the same during the period of study. The PK however, exceeded KP after 4 weeks of age, balancing the adverse maternal effect exhibited at hatching,, thus reaching almost the same weight as KP at 12 weeks of age as adiscussed above. Comparing P and K breeds, it is clear tht P had a higher rate of growth during the 2 periods 0-2 weeks and 2-4 weeks of age. The rapid growth rate of P in this period may be due to higher percent of yolk for the Pekin egg gave the birds feed supply for earlier growing. The K exceeded P at the period 4-6 weeks of age. The differences thereafter became of small magnitudes. Since she relative growth rate after 12 weeks of age for all breeds and crosses become very low the marketing of ducklings may then be done at 12 weeks of age.

TABAE 4.—AVERAGE ABSOLUTE AND RELATIVE GAIN

Age in Weeks	Breeds and Crosses							
	P		KP		PK		K	
	Absolute (Grams)	Rel. %	Absolute (Grams)	Rel. %	Absolute (Grams)	Rel. %	Absolute (Grams)	Rel. %
0–2	102.4	106.4	94.7	104.4	74.9	98.1	63.0	93.2
2–4	314.1	103.3	265.6	104.5	214.5	104.1	167.7	97.4
4–6	404.2	61.3	393.1	60.2	409.1	71.8	324.2	73.7
6–8	421.6	40.2	390.2	37.6	442.9	42.2	288.3	40.9
8–10	382.2	23.4	364.7	23.3	315.4	26.2	265.2	23.9
10–12	261.2	15.4	216.9	12.9	276.5	19.6	222.0	17.6
12–14	111.7	5.2	80.0	5.2	71.4	3.2	92.4	3.2
14–16	56.5	2.8	80.7	5.3	78.2	2.6	74.9	3.3
16–20	75.4	1.1	95.7	3.7	–11.2	1.4	38.0	3.6
20–24	26.8	2.7	–53.1	–1.0	–53.9	–1.8	19.1	1.6

(1) Rel ative growth rate $= \frac{W2 - W1}{\frac{1}{2}(w1+w2)} \times 100$

At this age, however, there was still a significant difference beween the reiprocal crosses was of no statistical significance indicating the absence of maternal effect. Smith and Jaap in chicken (1957) observed also that maternal eifeci wos not clear 8 weeks of age. However, Godfrey *et al.* (1953) in chicken also, observed no maternal effect after 4 weeks of age .

The efficiency of feed utilization :

It can be seen in Table (5) that the birds consume more feed as they adv - ance in age till they reach the age of eight weeks. The highest amount of feed was consumed by birds during the period from 4 to 8 weeks of age. This period coincided with the highest relative growth rate and within it occurred the largest gain in weight. The total amount of feed consumed per bird till 12 weeks of age was the lowest in the K breed followed by PK. The P and KP consumed almost the same amount of feed, a reflection of their sizes.

The efficiency of feed utilization calculted biweekly till the 12th weeks of age showed a gradual decrease with the advanceent of age (Table 5). The feed efficiency during the period from 10-12 weeks of age ranged between 4.09 (in K) and 8.20 (in KP). This last figure seems to be very high. Nordskog and Ghostley (1957), observed in chicken, that the efficiency of feed utilizationd decreased with advanoement of age. Kamar and Mostageer (1963), showed that during the early weeks of life, chickens were very efficient in utilizing food. As the birds grow older, growth rate decreased and more food was required per unit increase in live weight.

TABLE 5.—THE AMOUNT OF FEED CONSUMED PER BIRD (IN KGS.) AND EFFICIENCY OF FEED UTILIZATION FROM HATCHING TILL 12 WEEKS.

Age in weeks	Breeds and Crosses											
	(P)			(KP)			(PK)			(K)		
	Amount of feed	Efficiency*	No*	Amount of feed	Efficiency*	No*	Amount of feed	Efficiency*	No*	Amount of feed	Efficiency*	No*
0–2	.211	2.12	45	.208	2.37	48	.276	3.15	44	.167	2.42	48
2–4	.265	1.12	45	.264	1.53	40	.535	1.94	44	.332	1.50	44
4–6	1.178	2.56	44	1.132	2.48	41	.966	2.61	44	.478	1.95	41
6–8	2.185	2.28	42	2.017	4.17	41	1.626	3.82	41	.974	2.23	32
8–10	1.944	4.80	41	1.988	4.91	41	1.686	3.42	37	1.037	3.98	24
10–12	1.573	4.82	41	1.729	6.02	41	2.064	5.70	37	1.772	4.09	23
0–12	7.356	—	—	7.418	—	—	7.153	—	—	4.760	—	—

* Efficiency = $\frac{\text{feed consumed (in kgs)}}{\text{gain in weight (in kgs)}}$

* No = The numbers of individuals used.

With respect to the accumultive feed efficiency till the 12th weeks of age (Table 6), it is clear that the two purebreds were better in converting feed into live weight, compared to their; cross-breds. Trail (1963), also observed that the cross-breds were less efficient than their parental breed, the K being better than P. Within the 2 crossbreds, that of the K mothers was also better than its reciprocal. Thus comparing only the two crosses it is clear that the PK is the best since it reaches almost the same weight at 12 weeks of age as the KP, and is better in feed efficiency. However, the K breed has the best efficiency of feed utilization, but its drawback is that its weight at marketing (12 weeks of age) is less than the crosses.

TABLE 6.—ACCUMULATIVE FEED CONSUMED AND FEED EFFICIENCY FROM HATCHING TILL 12 WEEKS OF AGE.

Age in weeks	Breeds and Crosses							
	(P)		(KP)		(PK)		(K)	
	Feed Consumed	Efficiency	Feed Consumed	Efficiency	Feed Consumed	Efficiency	Feed Consumed	Efficiency
0–2	.211	2.12	.208	2.37	.276	3.15	.167	2.42
0–4	.467	1.42	.472	1.81	.811	2.23	.499	1.72
0–6	1.654	2.08	1.604	2.24	1.777	2.42	.977	1.32
0–8	3.839	2.63	3.701	3.03	3.403	2.93	1.951	2.00
0–10	5.783	3.10	5.689	3.50	5.089	3.08	2.988	2.42
0–12	7.356	3.36	7.418	4.03	7.153	3.55	4.760	2.86

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تاثير الخلط على انتاج البط

١ ـ النمو

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الملخص

أجريت هـذه التجربة على نوعين من البط هى البكين والكاكى كامبل والخليط بينهما وكانت أهم النتائج المتوصل اليها هى :

١ ـ كان وزن الجسم عند الفقس لكتاكيت البكين وخليط الكاكى كامبل × البكين أثقل منها بالنسبة للكاكى كامبل وخليط البكين × كاكى كامبل . وكما كان فى كل الأعمار التالية يعطى البكين دائما وزنا أعلى والكاكى كامبل أقل وزن بالنسبة للمجموعات الأربعة .

كانت الكتاكيت الناتجة عن أمهات بكين أعلى فى وزنها عن تلك الناتجة من أمهات الكاكى كامبل خلال فترة الدراسة من الفقس حتى ٢٤ أسبوعا وهذه الفروق كانت طفيفة عند عمر ١٢ أسبوعا وتظل كذلك لنهاية التجربة .

٢ ـ بالنسبة لزيادة الوزن كانت تصل الى أعلى ما يمكن فى الفترة من ٤ ـ ٨ أسابيع من العمر بالنسبة للمجاميع الأربعة .

٣ ـ كانت أكبر كمية من الغذاء المقدم بالنسبة للأربعة مجموعات تستهلك فى الفترة من ٤ ـ ٨ أسابيع وذلك فى المدة من الفقس حتى ١٢ أسبوعا .

كمية العليقة المأكولة بالنسبة لكل طائر حتى ١٢ أسبوعا من العمر كانت كالآتى :

(٧ر٣٥٦ ـ ٧ر٤١٨ ـ ٧ر١٥٣ ـ ٧ر٧٦٠ ـ ٤ر٧٦٠ كجم بالنسبة للبكين ـ خليط الكاكى كامبل × البكين ـ خليط البكين × الكاكى كامبل ـ الكاكى كامبل على التوالى) . الكفاءة الغذائية للأربعة مجموعات حتى عمر ١٢ أسبوعا كانت ٣ر٣٦ ـ ٤ر٠٣ ـ ٣ر٥٥ ـ ٢ر٨٦ كجم بالنسبة للبكين ـ خليط كاكى كامبل × البكين ـ خليط البكين × الكاكى كامبل ـ كاكى كامبل على التوالى .